Northwest **Power** and **Conservation** Council

May 6, 2025

MEMORANDUM

TO: **Council Members**

FROM: **Elizabeth Osborne**

SUBJECT: **Emerging Technology and Research at Pacific Northwest National Laboratory**

BACKGROUND:

Presenter: Dr. Jud Virden, Associate Laboratory Director for Energy and Environment, Pacific Northwest National Laboratory

Summary: Dr. Virden leads scientists and staff in key areas at PNNL including grid infrastructure modernization, research of renewable and efficient technologies, and nuclear science. He will discuss PNNL's work on emerging technologies for grid management and the contributions that demand side measures make to electric reliability.

More info: PNNL's Energy Resiliency research unit houses the Grid Storage Launchpad https://www.pnnl.gov/projects/grid-storage-launchpad and Electricity Infrastructure Operations Center https://www.pnnl.gov/electricity-infrastructure-operations-center

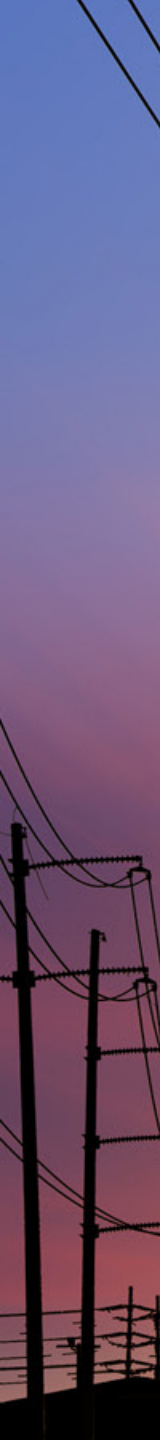
Pacific Northwest
NATIONAL LABORATORY

Emerging Technology

May 13, 2025

Jud Virden

Associate Laboratory Director
Energy and Environment Directorate



U.S. DEPARTMENT of ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

Pacific Northwest NATIONAL LABORATORY

PNNL exists to serve DOE's missions in science, energy, environment, and national security

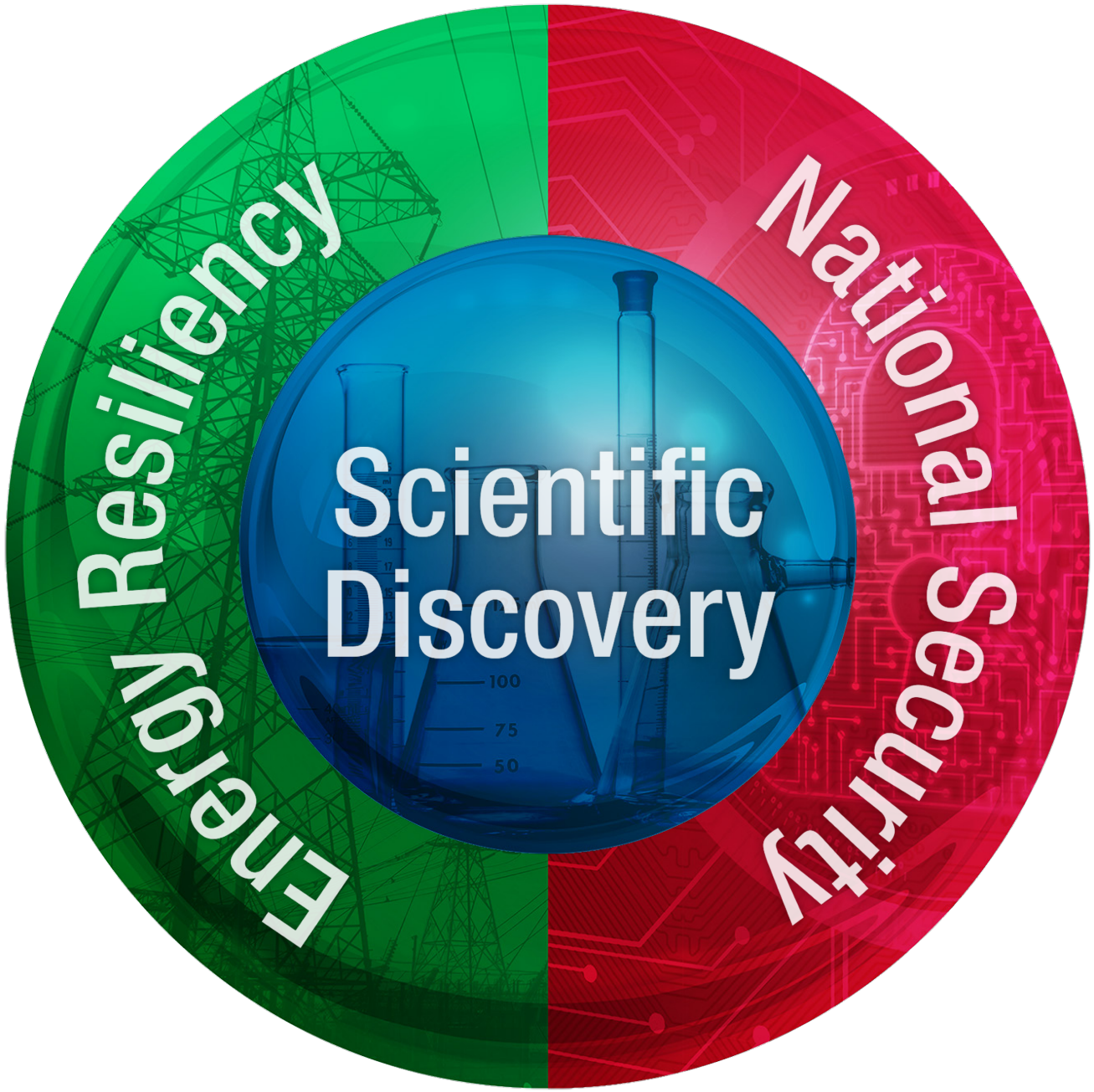
Energy

Science and Innovation

Nuclear Safety and Security

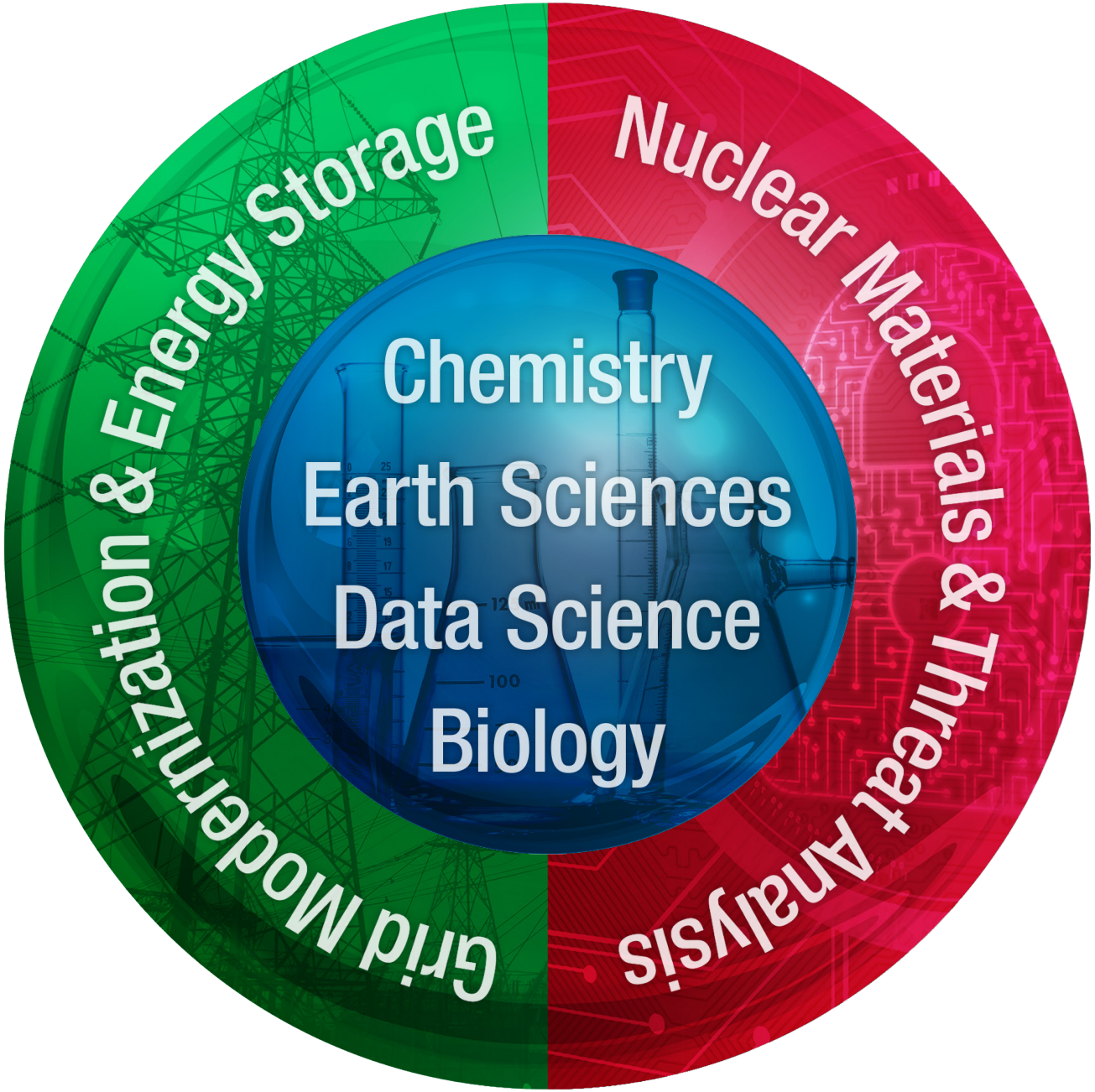
Pacific Northwest
NATIONAL LABORATORY

We **advance scientific frontiers** and **provide solutions** to critical national needs



Pacific Northwest
NATIONAL LABORATORY

Our distinguishing **strengths** enable mission **impact**



Pacific Northwest NATIONAL LABORATORY

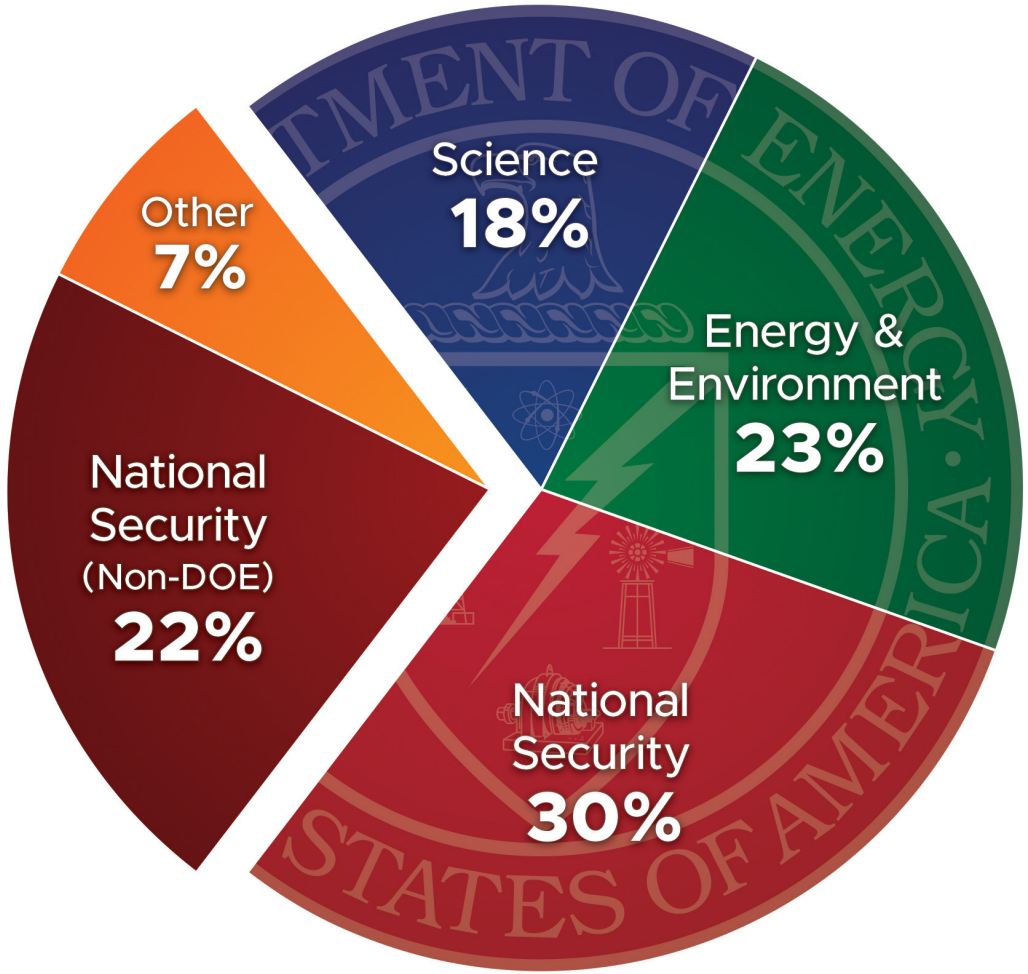
We are **one of DOE's most diversified** national laboratories

$1.64B **Annual Spending**
(Business Volume)

6,437 **Staff**
2,779 w/ advanced degrees

1,672 **Peer-Reviewed Publications**

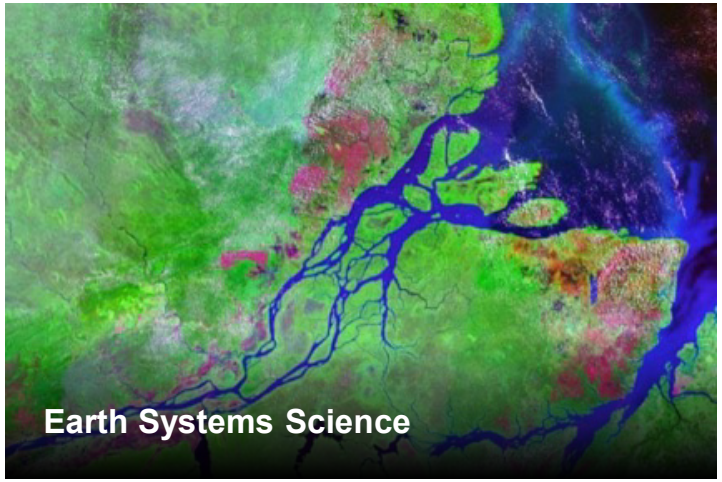
319 **Invention Disclosures**

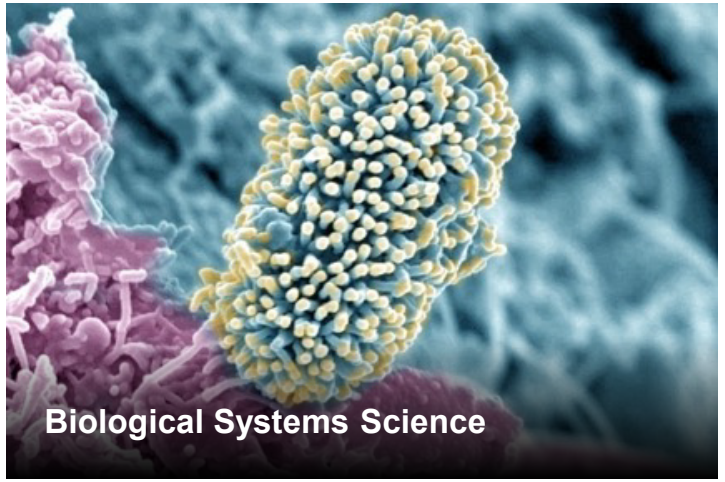


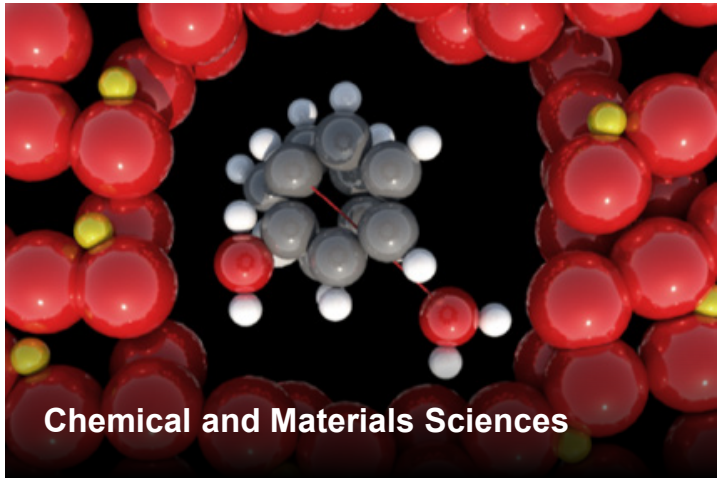
FY 2024 Business Volume

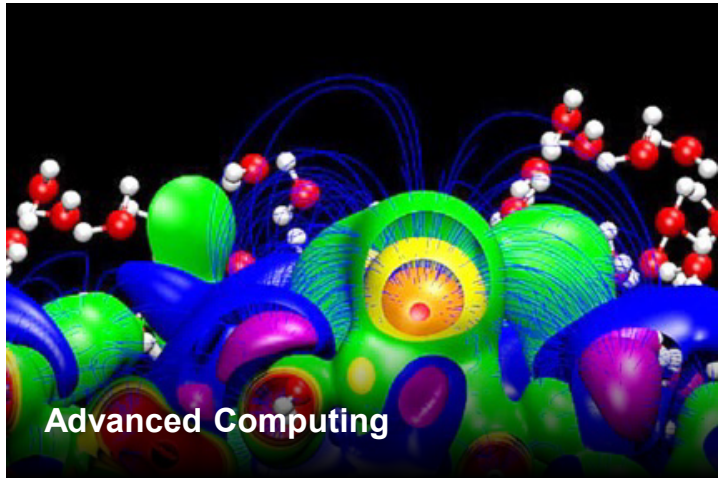
Pacific Northwest
NATIONAL LABORATORY

PNNL's **Science** mission advances understanding of the world around us



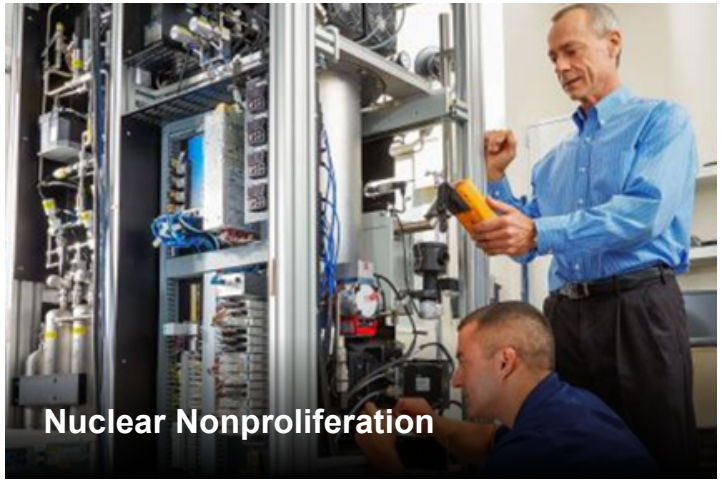


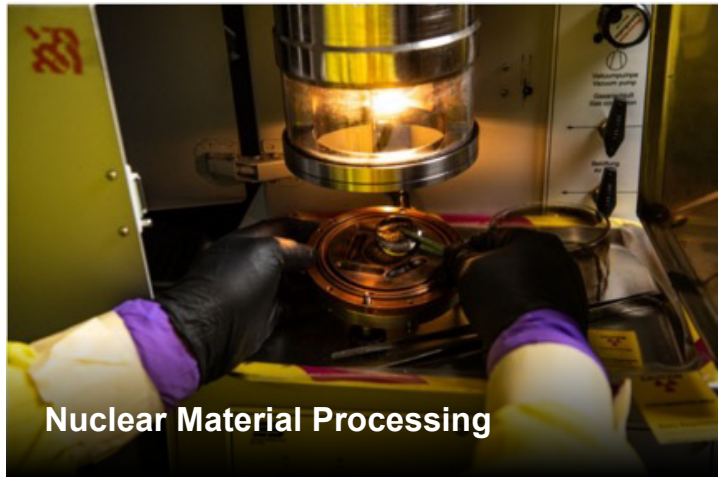


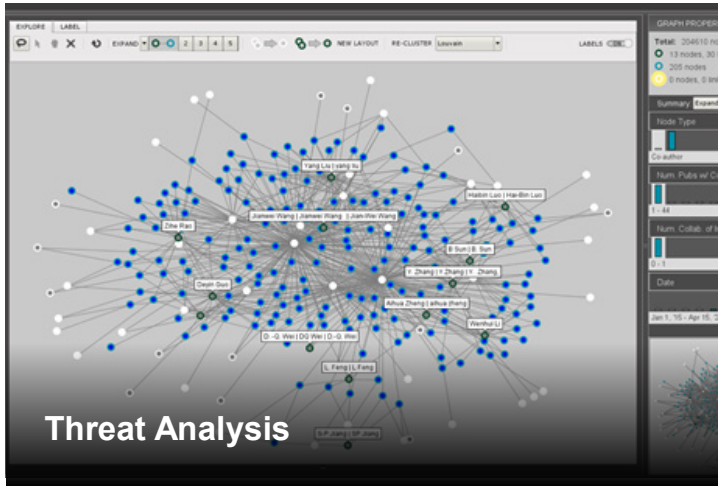


Pacific Northwest
NATIONAL LABORATORY

PNNL's **National Security** mission is reducing the threat from weapons of mass effect







Pacific Northwest NATIONAL LABORATORY

PNNL's **Energy and Environment** mission delivers innovations for our energy future

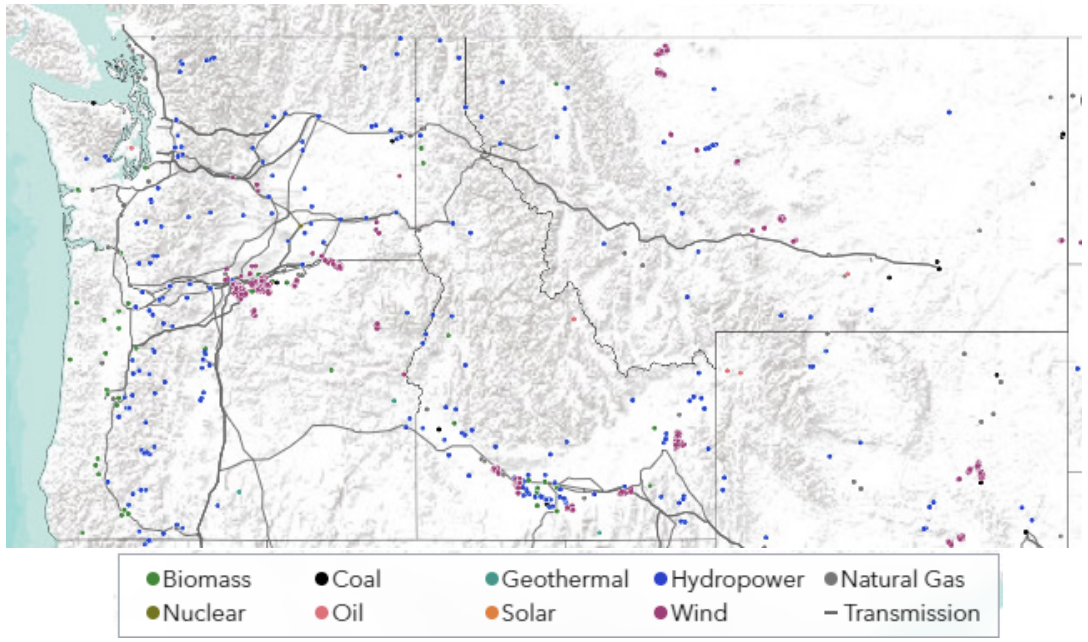
Pacific Northwest
NATIONAL LABORATORY

Key Facilities

Northwest Energy Study

Northwest energy dynamics are changing at an accelerating rate

- Understanding these dynamics at the regional level are increasingly important
- Individual/siloed utility planning and resource acquisitions may miss broader regional efficiencies
- The region will benefit from analysis and planning to optimize system investments across utility territories



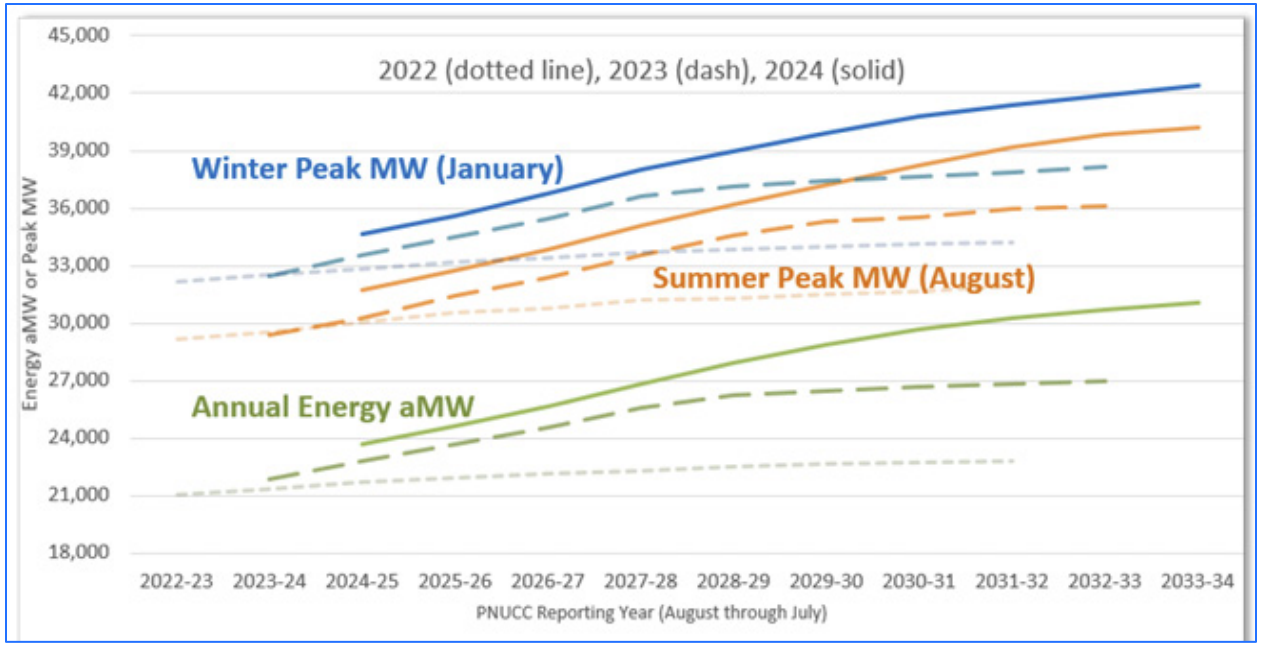


Image sources: GODEEEP godeeep.github.io/cerfscrolly/ and https://www.pnucc.org/system-planning/northwest-regional-forecast/

Modeling wildfire risk

Objective

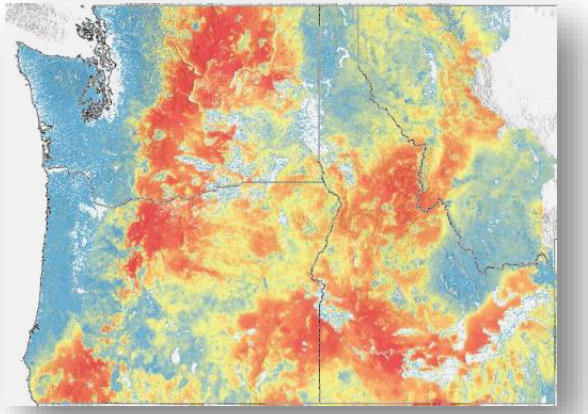
Develop actionable baseline + forward-looking *probabilistic* and *scenario-based* wildfire behavior to understand potential exposure of high value resources and assets to wildfire hazards

Outcome

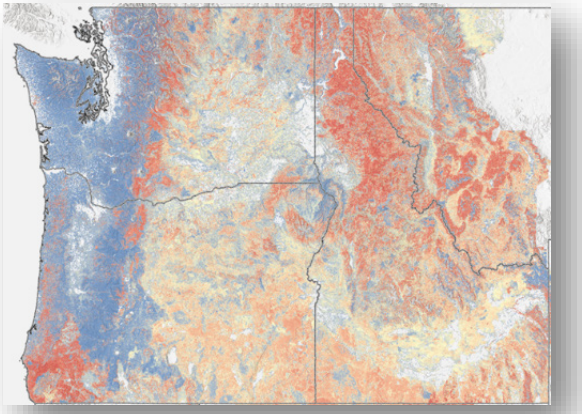
Informed decision-making for risk mitigation measures, operational controls and protection strategies, and strategic investments over time

- Health and safety protection
- Minimize damage to resources and assets
- Maintain reliability in critical systems
- Protect environmental and cultural resources
- Minimize economic impact
- Critical information for wildfire mitigation plans and emergency response planning

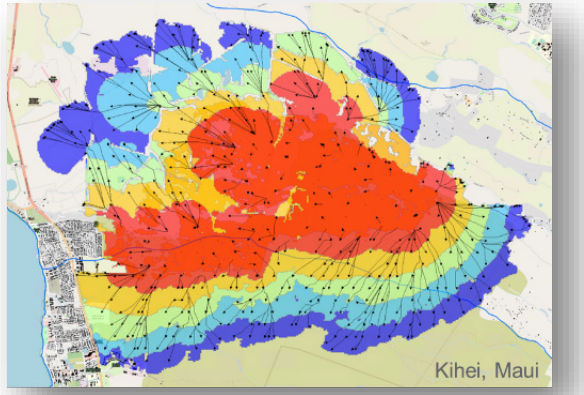
Burn Probability



Fire Intensity



Fire Spread



Batt500 Consortium

- PNNL leads the Innovation Center for Battery500 Consortium on behalf of DOE
- Double the energy density of current batteries
- World-Class team of battery experts from the national laboratories, academia, and industry.

ShAPE – reshaping the way metal is extruded

- Shear Assisted Processing and Extrusion
- Focused on ultraconductors for electricity and motors.
- Cost and energy savings, plus potential for improved material properties, can benefit a variety of industries.

Artificial Intelligence - Energy

- AI performance on demanding benchmarks continues to improve.
- AI is increasingly embedded in everyday life.
- Business is all in on AI, fueling record investment and usage, as research continues to show strong productivity impacts.
- The U.S. still leads in producing top AI models—but China is closing the performance gap.
- The responsible AI ecosystem evolves—unevenly.
- Global AI optimism is rising—but deep regional divides remain.
- AI becomes more efficient, affordable and accessible.
- Governments are stepping up on AI—with regulation and investment.
- AI and computer science education is expanding—but gaps in access and readiness persist.
- Industry is racing ahead in AI—but the frontier is tightening.

Pacific Northwest
NATIONAL LABORATORY

Thank you

U.S. DEPARTMENT of ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy